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AUTHOR Bhat, D.N.S.
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RETROFLEXION: AN AREAL FEATURE

D.N.S. Bhat
Language Universals Project,
and Deccan College, Poona

ABSTRACT

The occurrence of retroflexion in about 150 selected languages is examined in this paper from a geographical and a diachronic point of view. The clustering of such languages into distinct areas has been explained through the postulation of a hypothesis regarding their development in language. After a detailed examination of four different areas of retroflexion, their known history, and the present position of retroflexion in them, an attempt is made to generalize the environments that induce retroflexion in a given sound, and also to postulate developmental tendencies. Lastly, the place of retroflexion in a system of phonetics is explained.

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1. Introduction:

1.1. The term retroflexion refers to the "turning back" or "curling in" of the tip of the tongue while producing apical consonants, or somewhat rarely, vowel sounds as well. The articulator is almost invariably mentioned as the tip of the tongue; that is to say, retroflexed consonants are always apical. One also finds occasionally the articulator being specified as the back part of the tip of the tongue; it is possible, however, that the back part of the tip is used as the articulator in other cases even when it is not specifically mentioned in descriptions.

Since the tip of the tongue is neutral in the articulation of non-apical and non-laminal consonants, it could as well assume the retroflexed position during the production of such consonants. The presence of such a "co-articulation", however, has been reported rather rarely (see Pichel, 1964 for SHERBRO, Allen, 1951 for SANSKRIT, and Lorimer, 1935 for BURUSHASKI), and that too as an anticipatory or perseverative articulation of the neighboring sounds. Such consonants, however, are not reported to contrast with the non-retroflexed consonants in any of the languages examined by us.

1.2. The point of articulation and the amount of curling of the tip of the tongue are two other variables occurring in the articulation of the retroflexed sounds. Curling may range from "extremely strong" to "very slight", depending upon the particular language under study, the segment under consideration, and the environment in which it occurs. The point of articulation also appears to vary from dental (Thomas, 1971) to mediopalatal. None of these variables, however, are reported to be linguistically relevant in any of the languages examined by us.

One possible exception, however, could be the case of BADAGA vowels (Emeneau, 1939). A three-fold vowel contrast is said to occur in this SOUTH DRAVIDIAN language of India: non-retroflexed, half-retroflexed, and fully retroflexed. Of these, the second is evidently an apically retroflexed vowel, produced with the tip of the tongue curved upwards. But the third appears to have a non-retroflexed apex: it has a strongly retracted tongue, with its edges curved, and there is said to be a v-formation at the tip of the tongue. Since both these latter vowels are diachronically connected with their neighboring (mostly elided) retroflexed consonants, they have been termed as retroflexed vowels.

1.3. Acoustically, the retroflexed consonant is said to have energy in a lower frequency region, affecting the third formant of the following vowel in a downward direction. Such a shift has been considered as the manifestation of the feature called "flatness". It also characterizes the pharyngealized consonants and the consonants with lip-rounding (Jakobson, Fant and Halle, 1963). According to Peterson and Shoup (1966), velarization and lip-rounding give an acoustic impression very similar to that of retroflexion, which is "a substantial reduction in the frequency of the third formant". Hence retroflexion will have to be defined, for the time being at least, only articulatorily.

1.4. The occurrence of this feature has been most prominently noticed and reported in the languages of the Indian sub-continent. Earlier scholars used the term "cerebral" for indicating this feature. According to Burrow (1965), "this somewhat infelicitous name, a mistranslation of SANSKRIT mūrdhanya, dates from the very earliest days of INDO-ARYAN philology, and has stuck through habit". Semiticists and Dravidianists also use the term cerebral for indicating this feature. Another term, generally used in FINNO-UGRIC literature for indicating a similar articulation is "cacuminal": "the tip of the tongue, bent rather backward, comes into contact approximately with the central part of the roof of the mouth" (Gulya, 1966).

1.5. It appears that the retroflexed articulation could occur with all possible apical consonants. These could be stops, nasals, affricates, fricatives, sibilants, trills, flaps, laterals, or approximants. They could also be velaric (clicks), or glottalic (implosives or ejectives), and could show variations for aspiration, voice and murmur. However, the actual number of consonants that show a retroflexed-non-retroflexed distinction in a given language is rather small in most of the cases examined by us, and in some of the consonantal types such as the velaric, retroflexion is only a non-contrastive (free or idiolectal) articulatory feature (Beach, 1938).

1.6. The present study is based on an examination of the phonology and known history of about 150 languages that are reported to have retroflexed sounds occurring in them. Geographically, these languages occur in four fairly well-defined language areas, and three minor pockets. The languages vary considerably from one area to the other, and also inside an area to a certain extent, regarding the type of sounds that could occur as retroflexed, and also regarding their developmental history. Our plan in this paper is to present these areas individually and to summarize the general findings at the end.

2. Areas of retroflexion

2.1. India. The Indian sub-continent, with the languages of INDO-ARYAN, DRAVIDIAN, and MUNDA (AUSTRO-ASIATIC) language families, forms a distinct retroflex area (Emeneau 1956, Ramanujan and Masica 1969). It is bounded by an isogloss that cuts across the BENGALI language and leaves parts of that language and also ASSAMESE outside its sphere; SORA and KORKU of the MUNDA family, not having developed the retroflexed consonants, probably form a relic area in central India; whereas, a few TIBETO-BURMAN languages of the northern border, such as TIBETAN, SPITI, NEWARI, LEPCHA, and KANAWARI get included in the retroflex area by undergoing certain innovations of their own. Similarly in the north western frontier, IRANIAN languages like PASHTO, BALUCHI, and YIDGHA and language isolates like BURUSHASKI also show retroflexed consonants in them.

2.1.1. Languages occurring in this area agree in having a retroflexed stop which generally shows a contrast for voicing. Exceptions to this are CLASSICAL TAMIL (in which voicing was probably allophonic), TIBETAN and LUSHAI. Excepting those of the south, they also generally possess a contrastive aspiration, occurring with these stops. SINDHI has a retroflexed implosive contrasting with a retroflexed voiced non-implosive. Some of the MUNDA languages such as KHARIA and JUANG show glottalized retroflexed stops, which are, however, mostly non-contrastive: finally in JUANG (Matson, 1964) and in KHARIA between a vowel and a consonant or juncture (Biligiri, 1965).

Most of these languages have a retroflexed nasal, which, however, may or may not contrast with the dental or alveolar nasal. Intervocally (or in clusters with non-homorganic stops), the voiced stop tends to become a retroflexed flap especially in the southern languages such as TAMIL, KANNADA, MARATHI, MUNDARI, JUANG, (also KUMAUNI and KASHMIRI of the north, and dialectally in HINDI); some of these languages also have a nasalized flap as a variant of the retroflexed nasal, whereas a retroflexed flap occurs distinctively (from a retroflexed voiced stop) in some of the central and northern languages such as HINDI, NEPALI, BENGALI, LAHNDI, BALUCHI, PASHTO, GUJARATI, SINDHI, KUI, KONDA, PENGO, (also TODA and KOTA of the south).

The occurrence of a distinct retroflexed lateral is somewhat less common, reported mainly for the southern and western languages

such as TAMIL, TODA, KANNADA, TULU, MARATHI, MUNDARI, JUANG, GUJARATI, RAJASTHANI, SINDHI and LAHNDI. TODA has contrastive voiced and voiceless retroflexed laterals. Some of the literary dialects show a contrastive retroflexed fricative (sibilant) as well, which, however, is mainly restricted to SANSKRIT borrowings (KANNADA, MARATHI, TULU); it also occurs allophonically in KANNADA, KOYA, KOLAMI and GARHWALI; ṣ is distinct in KOTA and TODA, and in the case of the latter, it has a voiced counterpart as well. PASHTO (IRANIAN) has contrastive ṣ and ẓ; Morgenstierne (1938) reports the occurrence of ʂ̌ and ʐ̌ in some of the INDO-IRANIAN frontier languages such as SANGLECHI, ISHKASHMI, and YIDGHA. The last is also said to have a retroflexed affricate, which as a unit sound is somewhat unusual for this area. However, KOLAMI has ṭṣ (ṭ+t) and SANSKRIT borrowings occurring in TULU have ṭṣ instead of kṣ.

2.1.2. A majority of the languages belonging to this area have three different sets of consonants produced with the front part of the tongue: apical, laminal and retroflexed (i.e. produced with the tip of the tongue, blade of the tongue, and back part of the tip of the tongue). The following are a few examples of this type:

TULU (Bhat, 1967)

t	d	n	r	l	s	
ṭ	ḍ	ṇ		ḷ	ṣ	
č	ǰ	ñ			š	

HINDI (Mehrotra, 1964)

t	d	n	r	l	s	z	
ṭ	ḍ	ṇ	ṛ				(+aspiration)
č	ǰ	[ñ]			š		

MUNDARI (Gumperz & Biligiri, 1957)

t	d	n	r	l	s	
ṭ	ḍ	ṇ		ḷ		
č	ǰ					

PASHTO (Shafeev, 1964)

t	d	n	r	l	s	z
ṭ	ḍ	ṇ	ṛ		ṣ	ẓ
č	ǰ				š	ž

In some languages such as TELUGU (Krishnamurti, 1960), MARATHI (Kelkar, 1958), and KASHMIRI, the affricates have split into alveolar and palatal. They could however, be grouped with the three-position languages given above. Some have merged the palatal set into the apical set.

KONDA (Krishnamurti, 1969)

t	d	n	l	r	s	z
ṭ	ḍ	ṇ		ṛ		

A split of apical into dental and alveolar is seen in some, such as the following:

MALAYALAM (Subramoniam, 1962)							TODA (Emeneau, 1957)								
t	d	n	l		s		t	d	c	j		r		s	z	θ
t̲		n̲		r			t̲	d̲			n	r̲	l	l̲	s̲	z̲
ṭ	ḍ	ṇ	ḷ			R	ṭ	ḍ			ṇ	ṛ	ɭ	ḷ	ṣ	ẓ
č	ǰ	ñ			š				č	ǰ					š	ž

2.1.3. The amount of retroflexion varies from region to region, and is probably most prominent in the south (Firth, 1948) and in the west (Grierson). As one moves to the east and north, the amount of retroflexion as well as the number of distinct retroflexed segments get diminished; they are absent in the extreme east.

2.1.4. Diachronically the position of retroflexion is quite clear in DRAVIDIAN. A series of four retroflexed consonants (stop, nasal, lateral, and a continuant) have been reconstructed for PROTO-DRAVIDIAN, contrasting with an apico-alveolar series of stop, nasal, lateral and trill, and a palatal series of an affricate and a nasal. Additionally there is a dental series consisting of a single stop consonant (Krishnamurti, 1960). It is possible to treat the apical stop as a tap (contrasting with the apical trill) and thereby postulate only three positional contrasts for the front of the tongue: apical, laminal and retroflexed. The retroflexed consonants occur only word-medially; stops are voiced medially 1) in clusters with voiced consonants and 2) intervocally.

The main changes that affected the retroflexed consonants in these languages were the following: loss of retroflexion from nasals and laterals in the central and northern languages, and also in certain dialects of the south; loss of the continuant in KUDUX (north); change of the continuant to a retroflexed lateral (and to ɣ in some cases and conditionally to apical r) in the southern languages and to a retroflexed flap (and to r) in the central languages. Vowels preceding retroflexed consonants are centralized and retroflexed in some of the southern languages like TAMIL (also KOYA, KOLAMI); BADAGA has even developed contrastive retroflexed vowels (see 1.2.). The alveolar stop (or flap) has developed into a retroflexed flap in some of the central languages, whereas it has merged with the dental stop or r in some of the southern languages.

2.1.5. Retroflexion is problematic in the reconstruction of PROTO-MUNDA (Austro-Asiatic). The present opinion appears to favour the reconstruction of *t and *ḍ, with a primary opposition of voice and a secondary opposition of retroflexion. The development of a four-way opposition t ṭ d ḍ in most of the modern languages is ascribed to borrowing. Similarly, the r-ṛ opposition found in many MUNDA languages also is not reconstructed for PROTO-MUNDA (Stampe, 1966).

2.1.6. As for the INDO-ARYAN languages, the development of retroflexed consonants is clearly an areal feature. Genetically, it cannot be traced back farther than PROTO-INDO-ARYAN, even though the conditioned development of IE *s to a retroflexed sibilant in INDO-ARYAN is paralleled by its development into a palatal in IRANIAN and to a velar x/palatal š in SLAVONIC (Allen, 1954). As far as the inherited words are concerned, retroflexion developed in INDO-ARYAN through the following conditioned changed: IA *š and *ž changed to ṣ and ẓ in the presence of a preceding r, ṛ, i, u, or k (also diphthongs). Later, *ṣt > ṣṭ, and *ẓd > ḍ; *ss > *ṭṣ > ṭ finally, and > kṣ intervocally; n > ṇ after r, ṛ, ṣ in the same word and before a vowel, nasal or semivowel, except when 1) a dental or a palatal consonant (other than y) intervened, or 2) another retroflexed consonant or r followed (Katre, 1942; Allen, 1951, 1954; Burrow, 1965). Borrowing and later diachronic changes have gradually increased the number of retroflexed consonants and the number of positions in which they can occur in some of the modern INDO-ARYAN languages, and have decreased it in some others. Complete loss of retroflexion has occurred in ASSAMESE and dialects of BENGALI (Grierson).

The most important changes that affected the retroflexed consonants in these languages were 1) ṣ to š or s throughout, 2) ṇ to n and ḷ to l (in the eastern and central dialects), and 3) intervocalic ḍ and ḍh to ṛ and ṛh (and further to r and rh in the eastern area). Allen (1954) has generalized the above trend of change as follows: in OLD INDO-ARYAN (SANSKRIT) the tendency was for the retroflexion to have "more extensive syntagmatic implications" while co-occurring with constriction (i.e. with the fricatives or liquids), rather than with occlusion (i.e. with stops or the nasal); this tendency has been reversed in MIDDLE INDO-ARYAN, with a great increase in retroflexed occlusives, and a complete elimination of retroflexion in constriction.

2.1.7. In the IRANIAN languages bordering INDO-ARYAN, the development of retroflexion has evidently taken place through a different

set of diachronic changes, even though the trend has been set by the area to which it belongs (as in the case of INDO-ARYAN and other language families). In YIDGHA, for example, retroflexion has developed in native items as follows: rt to ṛ, rn to ṇ, str to ṣ and rš to ṣ. In SANGLECHI rn to ḷ (with nasalization of the preceding vowel. st to ṭ; rt, rd to ḷ, š to ḷ (and further to l) (Morgenstierne, 1938).

2.1.8. Retroflexion is an areal innovation in SINO-TIBETAN languages as well. TIBETAN and its closely related neignboring languages show an interesting case of change: syllable-initial consonant clusters ending in r are changed into voiced or voiceless stops. (This, of course, is part of a more extensive change which affected all initial clusters.) The following are some of the instances given by Grierson.

CLASSICAL TIBETAN	Gloss:	Modern languages	
grod-pa	'belly'	CENTRAL TIBETAN:	ḍhŏ-pa
drung-du	'before'	CENTRAL TIBETAN:	ṭung-du
phru-gu	'child'	CENTRAL TIBETAN:	ṭhu-gu
krad-pa	'leather'	SPITI:	ṭad-pa
khron-pa	'a spring'	SPITI:	ṭhon-pa
'agrang-ba	'to satisfy'	NYAMKAT:	ḍang-wa
'adri-ba	'asked'	NYAMKAT:	ḍi-ya
skra	'hair'	JAD:	ṭa
gru	'ship'	JAD:	ṭu
bran	'slave'	JAD:	ṭan

(In some dialects such as LHOKE and DANJONG-KA, the above change does not occur in cases where r is preceded by a velar consonant; instead, kr, khr and gr change to ky, khy and gy).

2.2 Australia. This forms another important area for retroflexion. The native languages of Australia, excepting those found in the north-east and east (Queensland) are reported to have a distinct series of retroflexed consonants. Languages found in the northeastern islands such as New Caledonia, Loyalty islands, and New Hebrides also have retroflexed sounds. The group of islands to the north in the Pacific Ocean, such as New Guinea, Java, Borneo, Philippines, Taiwan and others form a distinct sub-group, and the south-eastern part of Asia (Vietnam and Thailand, and areas extending up to Peking) is probably connected to it.

2.2.1. The native languages of Australia resemble those of India in a number of points. They are, however, typologically more uniform, evidently because of their close genetic relationship. The retroflexed series of these languages generally includes a stop, a nasal, a lateral, and a continuant. It may also include voiced or aspirated stops (generally non-contrastive), and stops with lateral or nasal release (Voegelin et al., 1965). These are said to contrast maximally with one non-retroflexed apical set and two non-retroflexed laminal (dental and palatal) sets of consonants, and minimally with one apical and one laminal (mostly palatal) sets of consonants. (This is in addition to the sets of labial and velar consonants.) There would be a stop and a nasal in each of these sets; there would also be a lateral in most of the languages, with exceptions occurring in the laminal sets. The retroflexed continuant appears to occur in the northeastern part of the continent as well (Dixon, 1970, 1972).

The retroflexed consonants are rather rare initially. They have a tendency to retroflex the preceding vowels, but not the following ones (Oates, 1967). Morphophonemic r + t is realized phonetically as ṭ. These and the fact that "r occurs in clusters with stops and nasals other than alveolars as in TIWI has led to the assumption that the retroflexed sounds could be considered as r + alveolar consonant clusters" (Oates, 1967).

2.2.2. Three languages of Loyalty island -- DEHU, IAI and NENGONE -- are reported to have voiced and voiceless retroflexed stops, contrasting with alveolar (non-retroflexed) stops and alveo-palatal affricates; similarly, the languages of New Caledonia (CAMUHI, THUNGA and WAMOANG) and of Malekula Island (Central New Hebrides) such as URIPIV, AULUA and KULIVIU are also reported to have retroflexed stops and nasals (Voegelin et al., 1965).

2.2.3. The remaining languages included in this area form a sub-group, and are quite different from the foregoing in that they generally have a single retroflexed consonant to represent the series. In the NEW GUINEAN languages, for example, it is a lateral in WARIS, TELEFOL and WERI, a lateral flap in MENDI, TAMI, and PAWAIN, a flap in DARA, BINUMARIEN and KEWA, a trill in KUNIMAIPA and a mid-central vocoid in BALANGAO. It is also a fricative in SA'BAN of Borneo, a trill (?) in MENTOK-MALAY, a flap (slightly trilled initially) in CAMBODIAN, and a retroflex continuant in certain THAI dialects.

Retroflexion is mostly an allophonic feature in these languages. That is, the sounds under consideration are distinguished from other sounds in the respective languages by more than one feature, and retroflexion is generally subsidiary to other features such as the manner of articulation (trill, flap, lateral, fricative, etc.). Hence the sounds could be classified with other non-retroflexed sounds in these languages. Generally, the languages have a single set of consonants produced by the front part of the tongue, even though some of them, such as KEWA and SA'BAN, distinguish between palatals and apicals. The distribution of retroflexion is further restricted by the environment or by the optionality in some of these languages: retroflexion is optional in THAI, TAMI, IATMUL (could be alveolar), MENTOK-MALAI (could be uvular), DARA (only non-initial) and TELEFOL (only final and after a); it occurs only after back vowels in WERI; and only non-initially in "non-alveolar" environments in BELANGO. It is only initial in SA'BAN.

2.2.4. The position of retroflexed consonants continues to be problematic in AUSTRONESIAN reconstructions. Dempwolff traces back t, ṭ, and d, ḍ (and also l, ḷ) as distinct sounds for common INDONESIAN. Of these the position of the contrast between t and ṭ is said to be somewhat doubtful (Handricourt, 1965). Handricourt suggests the reconstruction of t and ḍ in place of t, d, ṭ, ḍ. Dyen sets up l and r instead of l and ḷ. In most of the POLYNESIAN languages, d, ḍ, l and ḷ have fallen together to l, whereas in the MELANESIAN languages, l and ḷ are kept distinct (but d and ḍ fall together to d) (Milner, 1963). JAVANESE retains all these distinctions; TAGALOG changes d to r and ḍ to l intervocally and ḍ to d initially and after consonants (Dyen, 1947).

2.2.5. Two languages of Vietnam -- VIETNAMESE (VINH dialect) and CHAM -- and also the language of Java differ from the above languages in having their stops (and nasals) also retroflexed. CHAM is reported to have the following retroflexed consonants: ṭ, ṭ', ṣ, ṇ, r̃, and ẓ. The first three are phonemicized as clusters of alveolar consonants followed by r; the next three are positional variants of l occurring finally; and the last is a dialectal variant of r (Blood, 1964). VIETNAMESE has a retroflexed tr affricate, nasal ṇ (allophonic), and fricatives ṣ and ẓ (Emeneau, 1951). JAVANESE is reported to have two contrastive retroflexed stops ṭ and ḍ.

To the north of Vietnam and Thailand, retroflexion is reported to occur in certain SINO-TIBETAN languages such as MIAO (ṭ, ṣ, ẓ),

YAO (ḍ, ṇ), HSIANG (ṭṣ, ṣ, ẓ), and MANDARIN (ṭ̌ṣ̌, ṣ̌, ẓ̌) (Voegelin et al., 1965). Hashimoto (1973) reconstructs retroflexed initials and endings of syllables for ANCIENT CHINESE; the syllables having low syllabic vowels and velar consonant endings are said to develop a rounded medial vowel when preceded by a retroflex initial (as in PEKING MANDARIN); the tense-lax distinction is neutralized after retroflex initials or labial (or labialized) endings; retroflex endings of HAINAN dialect correspond to dental endings of other dialects; and the retroflex initials of PEKINESE correspond to velar initials of northern MANDARIN before rounded vowels.

From our study of the development of retroflexion in various language families as described below (3.2-5), it would appear that the postulated direction of change in the above reconstruction is incorrect. It is probably the rounded vowels and velars that induce retroflexion in the above languages rather than the other way round. Additional study is necessary to know the exact nature of this area and its connection with the INDIAN or the AUSTRALIAN retroflex area.

2.3. America. Another retroflex area exists across the Pacific, starting from California and extending up to Brazil and Chile, along the Pacific coast of the two continents. In the extreme north, it has also been reported to occur in certain ATHAPASKAN languages of Alaska. Included in this area are a number of AMERICAN INDIAN languages belonging to different language families such as ATHAPASKAN (YUKON, INGALIC, KUTCHIN, HAN, TOLOWA), UTO-AZTECAN (HOPI, CORA, CUPENO, PAPAGO, SERRANO), KERES (ACOMA), MIXE-ZOQUE (WESTERN ZOQUE, MIXE), POPOTECAN (MOLINOS MIXTEC, HUAJUAPAN MIXTEC, POPOLOC), MAYAN (AGUACATEC, IXIL, KANHOBAL), YUMAN (YUMA), PANOAN (CAPANAHUA, SHIPIBO-CONIBO, MARINAHUA), TAKANAN (TAKANA, CAVINENA), CARIBAN (CARIB, TRIO, WAYANA), TUCANOAN (SIONA), ARAWAKAN (PIRO), AMUESHA, YOKUTS, TARASCAN, QUECHUA, and ARAUCANIAN.

2.3.1. Most of these languages occurring in this area do not have a distinct retroflexed series. They resemble the cluster of languages to the north of Australia (AUSTRONESIAN) in this respect. In some of the languages such as MAIDU, SIONA, MIXTEC, TRIO, QUECHUA, and YUMA, retroflexion is only allophonic, occurring in restricted environments. In certain others such as MIWOK and ZOQUE it is dialectal. Even in languages in which it is fully contrastive, retroflexion

is generally restricted to a small section of the manner column, namely the fricatives and affricates. Only a few languages such as YOKUTS form exceptions to this generalization.

2.3.2. The most frequently occurring retroflexed sounds in these languages are 1) sibilants or fricatives (in about 25 languages or language groups), and 2) affricates (15 languages). The latter is restricted to MAYAN, TAKANAN and ATHAPASKAN languages and also to AMUESHA, CAMSA, ACOMA, SERRANO and ARAUCANIAN. CARIBAN languages have a retroflexed flap. A retroflexed glottalized stop is seen in SIONA (TUCANOAN), and a prenasalized retroflexed stop in MIXTEC. A number of UTO-AZTECAN languages belonging to this area such as HUICHOL, PAPAGO, CUPENO, LUISENO, SERRANO and HOPI are reported to have a retroflexed fricative. SERRANO (ʊ̣, ɨ̣, a̤) and Tarascan (ɨ̣) have developed retroflexed vowels as well.

YOKUTS has probably the most fully developed retroflexed series among the languages of this area. The following are the lingual consonants occurring in the YAWELMANI dialect (Newman, 1946):

t d t' c c' s z, n n' l l'
ṭ ḍ ṭ' ç ç' ṣ ẓ,

2.3.3. Voegelin and others (1962) do not reconstruct retroflexion for PROTO-UTO-AZTECAN. Its development in PAPAGO (*c to ṣ before back vowels and *l to ḏ before *a), CORA, HOPI and SERRANO (Hill, 1969) are considered as later developments. (Bright and Hill (1967), however, refer to the "retention" of PROTO-UTO-AZTECAN *ṣ in CUPENO and LUISENO and of its merger with *s to s in CAHUILLA.) Similarly, in MIXE-ZOQUE, retroflexion is considered as an innovation (Wonderly, 1949). It is derived from an earlier labialized front velar series in the ATHAPASKAN languages of ALASKA and also in the Smith River ATHAPASKAN (Kraus, 1964). According to Gudschinsky (1959), retroflexion could be traced back to PROTO-POPOLOCAN *s̄ as an allophonic feature occurring before back vowels. For PROTO-MAZATEC, retroflexion has been considered as allophonic for *ty as well. From these, some of the daughter languages have later developed a retroflexed affricate. The feature is only allophonic in YUMA (Halpern, 1946), and also in QUECHUA (Parker, 1969).

McQuown (1956) reconstructs two retroflexed affricates (simple and glottalized) for PROTO-MAYAN, to which Olson (1964) adds a sibilant (also for PROTO-MAYAN-CHIPAYA). Kaufman is reported

to have discarded all the three (Longacre, 1968). It would be interesting to see how its development in the daughter languages is explained by him (See 3.2.4.(1.h)). Shell (1965) reconstructs a single retroflexed alveopalatal *s̆ for Reconstructed PANO, which, however, is assumed to be non-retroflexed in the front-velar position. It is attested as x (velar fricative) in AMAHUACA. An additional retroflexed sound, (alveopalatal affricated flap) corresponding to the alveolar flap of other languages is said to occur in SHIPIBO-CONIBO.

Girard (1971) reconstructs a retroflexed affricate for PROTO-TAKANAN, but rather oddly, no corresponding non-retroflexed affricate. The two daughter languages with retroflexed affricates, CAVINENA and TAKANA, both have corresponding non-retroflexed affricates (Key, 1968). Only YOKUTS has a complete set of retroflexed consonants, forming a fully developed series of stops and affricates. Golla (1967) reconstructs the following for common YOKUTS: ṭ, ṭh, ṭ', c̣̆, c̣̆h, c̣̆'.

Retroflexion is thus a comparatively recent development in most of the languages and language families of this area. The most prominent conditioning factor is a following back vowel, affecting mostly the fricatives and affricates. Because of the recentness of the development of retroflexion in these languages, their conditioning factors are easily extracted, and in quite a few cases, such factors still remain intact.

2.4. Africa. Another major retroflex area is central Africa -- coast to coast from Guinea to Somali Republic, and Tanzania. Languages belonging to different families and stocks spoken in this area such as SHERBRO (WEST ATLANTIC); EWE and BINI (KWA); HAUSA (CHAD); KANURI (SAHARAN); BAGIRMI, MORU, BIRRI, BONGO, LUGBARA and DAIR (SUDANIC); BERTA; BEDAUYE, GOLLA, and SOMALI (CUSHITIC); WELAMO (OMOTIC); KONDE and MOMBASA SWAHILI (BANTU) are reported to have retroflexed sounds.

Retroflexion, however, is not a prominent feature in most of the languages of this area. According to Ladefoged (1964), for example, it is not as pronounced as in the Indian languages; in Ewe and some of the neighboring TOGO languages, he reports the articulation to be made usually (but not always) with the back part of the tip of the tongue. That is, retroflexion is an optional feature in those languages. Such an optionality and also the "weakness" of retroflexion in this area has been frequently referred to by Tucker and Bryan (1966) and Meinhof (1932) too.

Retroflexion in this area is mostly restricted to a flap (derived from t, r, or l). It is only secondarily extended to stops that occur in clusters with an r. Thus, in LUGBARA, tr and dr are retroflexed, and there is a tendency to eliminate the r element although the consonants remain slightly retroflex and are often followed by friction (Tucker, 1940).

Another important source of retroflexion is an imploded apical stop, which tends to get retroflexed in this area, and sometimes, as a result, even loses the implosion itself. In MORU-MEDI, for example, the retroflex tongue position is said to be a more distinguishing feature than the implosion (Tucker, 1940). There is also a tendency for the retroflexed apical implosive to become ʔr or ʔḷ and change further to r or l (Greenberg, 1970). In the CUSHITIC and OMOTIC languages spoken in Ethiopia, there is said to be "a voiced stop, contrasting with d, which is pronounced somewhat farther back (post-alveolar or retroflex), is often implosive, may have r-like flap pronunciation between vowels, and may interchange with r in some grammatical processes" (Bender et al.).

Retroflexion is evidently a recent innovation in most of the languages of this area. The exact nature of its development, and the external contacts involved, however, are not yet clear.

2.5. Other minor pockets. In addition to the four major retroflex areas discussed above, we have also noted three minor pockets of retroflexion. The exact nature of these is not yet clear. The pockets occur in southern Africa, Scandinavia, and Caucasus.

2.5.1. In southern Africa, retroflexion has been reported in the following languages: in NDEBELE of northern Transvaal, nr is a cluster of nasal and fricative, both retroflexed (Ziervogel, 1959) in VENDA (south-eastern BANTU of northern Transvaal), a flapped retroflexed lateral contrasts with a dental lateral; in the RONGA cluster of TSONGA (Mozambique), prepalatal explosives occur as retroflexed ṭ', ṭh, ḍ, ṇ and ṛ; in PAI (eastern SOTHO), spoken in Transvaal, a number of retroflexed sounds such as ṭ, ẓ, ç' and ṣh occur; in PULANA and KUTSWE of the same area a voiced stop occurs as retroflexed (Doke, 1954).

2.5.2. SWEDISH and NORWEGIAN have developed retroflexed stops, nasals, laterals and fricatives through innovation in clusters with r as the first consonant. FAROESE has developed a retroflexed fricative from an rs cluster (Lockwood, 1955). BRETON is said to

have ɳ and ɭ dialectally, occurring in restricted environments (Jackson, 1967). In England, ENGLISH r has been changed into a retroflexed flap in its south-western dialects (Wakelin, 1972). This probably forms the source of retroflexed vowels that are reported to occur dialectally in AMERICAN ENGLISH.

It is possible, that the retroflexion in the above languages is induced by contacts with URAL-ALTAIC languages, which, according to Collinder (1960) had three different retroflexed (cacuminal) sounds in their proto-form. Only OSTYAK (with a series consisting of a lateral, nasal and an affricate) appears to have retroflexion among the modern URAL-ALTAIC languages, and according to Raun (1971), even the whole question of positing retroflexed sounds for PROTO-FINNO-UGRIC is still a problem.

2.5.3. In the Caucasus, Allen (1956) reports the occurrence of a number of retroflexed prepalatals in ABAZA, a language belonging to the NORTH CAUCASIAN family. ARMANIAN, with a retroflexed fricative derived from an earlier cluster with r is probably influenced by it. In the neighboring KURDISH (IRANIAN) language, the velarized lateral is realized as a retroflex lateral with some (rare) speakers (Mackenzie, 1961). It is possible that this pocket of retroflexion is a continuation of the Indian retroflex area. All these evidently deserve further study.

3. Developmental tendencies

3.1. An areal hypothesis. The geographical distribution of languages and dialects with retroflexed sounds given above is very interesting. Firstly, the languages occur in groups rather than in isolation. This has made it possible to deal with this feature here successfully from a geographical point of view. Secondly, the groups are made up of languages or dialects belonging to different language families rather than to one single family. And the grouping is such that in each area there are at least some constituent language families in which retroflexion is an innovation developed conditionally (and through borrowings) by some of its daughter languages, and is hence not to be reconstructed for the proto-stage. The boundary of such a group of languages with retroflexion never coincides with the boundary of any given language or language family. In fact the retroflexion isogloss cuts across language families or even individual languages in such a way that some of the dialects would have that feature, whereas some other closely related ones would not have it.

It would be interesting to see whether any linguistic explanation could be given to the above geographical or areal limitation of the distribution of retroflexion among the languages of the world. Since our knowledge of the spread of this feature is still extremely limited, it would be premature to draw any theoretical conclusions from it at this juncture. However, the future course of data-gathering would be more purposeful and well-directed if certain working assumptions are postulated. One such assumption, we believe, would be to postulate that retroflexion could occur in a language either 1) through inheritance from the parent language, or 2) through contact with a neighboring language that possesses the feature through 1) or 2). That is, the presence of external contact could be postulated as a necessary (but not sufficient) condition for the development of retroflexion in a language that did not inherit it from its parent language. Such an assumption could explain the geographical clustering of languages that have retroflexion as a (distinctive or non-distinctive) articulatory feature.

We may perhaps extend the basis of the above postulation to form a more general hypothesis regarding language change. There are evidently two different types of diachronic changes that affect articulation: 1) those which shift, extend, or delete an existing articulatory movement (assimilatory changes, changes of stops to affricates or fricatives, raising, lowering or centralizing vowels, nasalization, denasalization, deglottalization, etc.), and 2) those which introduce new and non-existing articulatory movements into a language (retroflexion, implosion, palatalization as a secondary articulation, glottalization, double articulation, etc.). It would be interesting to see whether a distinction of the above nature in articulation changes could be correlated with their geographical spread, or with certain other characteristics that are typically present in them. Even if the introduction of new and non-existing articulatory movements are not necessarily conditioned by external contacts with languages that already possess them, such changes may share other interesting characteristics which are not found in diachronic changes of the first type. Hence, we feel that further research in this direction would be rewarding.

It must be specifically mentioned, however, that the above postulation is not based on the occurrence of retroflexion as an areal feature as such. A number of other features such as aspiration, depalatalization, palatalization, consonant lengthening, etc. have been considered by various linguists as characterizing language areas, as in India

(Emeneau, 1956), Ethiopia (Bender et al.) and others. It is the additional possibility of treating all the known occurrences of retroflexion as areal that has been used as the basis of the above hypothesis. Such a possibility, we believe, could exist only for a limited number of features, and it is our contension that these features may represent the introduction of new articulatory movements into the phonetic system of the languages concerned.

3.2. Environments that induce retroflexion. Linguistically, it is possible to specify the type of environment that could induce retroflexion in a given sound. Our study so far has indicated the following to be the most important environments: 1) a preceding r (apical tap or trill), 2) a following retroflexed consonant, 3) a following back vowel, and 4) implosion.

3.2.1. a preceding r. An apical tap or trill, though itself a non-reflexed sound, has the property of inducing retroflexion in a following consonant. Such a consonant may occur immediately after r (as in a consonant cluster beginning with r), or it may occur non-immediately in a following syllable. The most interesting is the case of n to ṇ in SANSKRIT, which has taken place even when a number of segments occurred between r and n as in ārabhyamāṇa (< *ārabhyāmana). The exact statement of the environments concerned is the following: in SANSKRIT, n became ṇ after r (or vocalic ṛ) in the same word and before a vowel, nasal or semivowel, except when 1) a dental or a palatal consonant (other than y) intervened, or 2) another retroflex consonant or r followed (Allen, 1951). (See below 3.2.3. for an articulatory explanation of this conditioning factor.)

There are a number of instances in which r induces retroflexion in an immediately following consonant. The following were noted by us.

(1) In MIDDLE INDO-ARYAN, dental stops became retroflexed after r (Burrow, 1955).

(2) In YIDGHA (IRANIAN), rt, rn, and rš became ṛ, ṇ, and ṣ̌ respectively (Morgenstierne, 1938).

(3) In SANGLECHI (IRANIAN), rt and rd became ḷ, and rn became ṇ and later ḷ (Morgenstierne, 1938).

(4) In PASHAI (IRANIAN) r plus dental stop results in a retroflexed consonant, but dental stop plus r remains unaltered (Morgenstierne, 1938).

(5) In certain AUSTRALIAN languages like TIWI, TINDJIPARNDI and NGARLUMA, rt becomes ṭ (Oates, 1967).

(6) In BURERA (AUSTRALIAN), t, n, l and r are retroflexed after r (Glasgow, 1967).

(7) In KUNJEN (PAMAN family, Australia), t and d are retroflexed after r (Sommer, 1969).

(8) In Trondheim NORWEGIAN t, d, n, l are retroflexed after r, and r is deleted (Vanvik, 1966). A similar change took place in SWEDISH too.

(9) In FAROESE (INDO-EUROPEAN) rs became ṣ finally or before consonants (Lockwood, 1955).

The following instance reported for KOLI (a MARATHI dialect) is interesting because it shows the effect of r in obstructing the de-retroflexion of a following consonant: in that dialect, ḍ becomes r except after an r plus a vowel (Laddu, 1958).

Retroflexion of consonants that occur before an apical r is reported only in MIDDLE INDO-ARYAN, where dentals are said to have become retroflexed "occasionally" when followed by r (Burrow, 1955); the change, however, was probably a regular one in SINDHI (Turner, 1924).

The TIBETAN change of initial consonant clusters ending in r into ṭ or ḍ (see 2.1.9. above), however, is of a different nature. It is paralleled by the change of other consonant clusters in which all consonants excepting the last are elided. Hence, it is a change of r to ṭ or ḍ, influenced by the preceding voiced or voiceless stop consonants which are then elided, rather than that of the consonants which preceded an r.

3.2.2. a following retroflexed consonant. Retroflexed consonants, on the other hand, have an anticipatory rather than a prolonging effect on their neighboring sounds. They have the property of inducing retroflexion in a preceding sound. The following are the instances noted that support this generalization.

(1) Retroflexion of a dental or an alveolar nasal occurring before retroflexed stops is a common phenomenon reported in a number of languages such as KHARIA, BALUCHI, KOYA, BENGALI, NORWEGIAN, etc. It forms part of the general tendency of nasals to get assimilated to the point of articulation of the following stops.

(2) There are a number of instances in which other consonants also have become retroflexed when occurring immediately before the retroflexed consonants.

a. In KHARIA (MUNDA) and BENGALI (INDO-ARYAN), l becomes ḷ before retroflexed stops (Biligiri, 1965; Ferguson, 1960).

b. In south-western England, t, d, n, s, z, l of ENGLISH are retroflexed when adjacent to (preceding?) the retroflexed flap as in the words tree, straw, etc. (Wakelin, 1972).

c. VIETNAMESE ṭ and ṇ occur after a vowel only if the following word has an initial retroflexed affricate (Emeneau, 1951).

d. In KOYA (DRAVIDIAN), s becomes ṣ before ṭ (Tyler, 1969).

e. In LUGAMBA (Uganda) t and d are retroflexed when occurring before a retroflexed r, which is a fricative after them (Barr, 1965).

f. In a dialect of KANNADA (DRAVIDIAN), rḍ and rṭ have regularly become ṇḍ and ṇṭ respectively (Upadhyaya, 1968).

g. In GUJARATI n does not occur before retroflexed stops (Pandit, 1957); and in SANSKRIT, dental stops do not occur before ṇ (Emeneau, 1946).

(3) There are two instances in which retroflexion affects a preceding consonant across a vowel.

a. In PARJI (DRAVIDIAN), when the first syllable of a word terminates in a retroflexed ṭ or ḍ, an initial dental ocurring before it is changed into a retroflexed consonant (Burrow and Bhattacharya, 1953).

b. MAYAN [ʧ'] became [ʧ̣'] before a vowel and a retroflexed ṣ in MAMEAN and AGUACATEC (Kaufman, 1969).

(4) Retroflexion and centralization of the vowels occurring before a retroflexed consonant also is a common phenomenon reported for MUNDARI, KONDA (before r), KOYA, TAMIL and MALAYALAM (for front vowels), KOLAMI (for e and e:), MARATHI, ARMENIAN and for most of the AUSTRALIAN languages such as THARGARI, PITTA-PITTA, MANTIJILTJARA, PINTUPI, etc. Specifically, the following instances may be noted in this respect:

a. In ARMENIAN (INDO-EUROPEAN), a vowel occurring before the retroflexed fricative is markedly retroflexed (Allen, 1950).

b. In TULU (DRAVIDIAN), i and e became u and o respectively before retroflexed consonants, when preceded by a bilabial consonant (Bhat, 1965).

c. In CHRAU (MON-KHMER) contrast between front and back vowels is neutralized before a retroflexed flap (and also before a lateral) (Thomas, 1971).

d. In TAMIL (DRAVIDIAN), k became c before front vowels, except when the vowel was followed by a retroflexed consonant (Burrow, 1968).

(5) The following are some of the additional instances that further support the above generalization by showing that the retroflexed consonants do not affect a following sound:

a. In BALUCHI (IRANIAN), retroflex flap is rare in consonant clusters, except before dental consonants (Barker and Mengal, 1969).

b. KUMAUNI (INDO-ARYAN) has ṭn, ḍn, ṇn as clusters medially, but not nṭ, nḍ, and nṇ (Apte and Pattanayak, 1967).

c. In ARMENIAN (INDO-EUROPEAN) a following dental is not affected by the retroflexed consonant (Allen, 1950).

Exceptions to the above generalization are rare, occurring mainly in cases where a retroflexed stop is immediately followed by l, r, s, or n; in such cases, the latter sound functions as the release of the former, and is hence retroflexed. Reported instances of this type of change are found in KOTA, KOLAMI, TULU, and NORWEGIAN. In PITTA-PITTA (AUSTRALIAN), vowels are retroflexed both when preceding as well as following a retroflexed consonant. However, the retroflexion is said to be weaker in the vowels following a retroflexed consonant (Blakd and Breen, 1971). In BENGALI, the vowel i is said to be somewhat retroflexed after ṭ, ḍ, lḍ, and lṭ (Ferguson, 1960).

3.2.3. An articulatory explanation. In SANSKRIT the change of n to ṇ pointed out above (3.2.1.) occurs after a retroflexed sibilant as well. Similarly, in ARAUCANIAN (Chile), n and l are retroflexed when preceded by the sequence $t^{h}V$ (retroflexed affricate and a vowel)

(Echeverria and Contreras, 1965). Evidently a retroflexed sibilant or affricate behave differently from other retroflexed consonants in that it influences the following sounds as well. We believe it is possible to explain this anomaly through an examination of the articulatory movements involved in the production of retroflexed consonants. For example, the tip of the tongue has to be curled in prior to the production of a retroflexed stop, flap, nasal or lateral, and the tip is to be released as the production of these sounds is terminated. In fact, such a release forms part of the production itself of these sounds. Whereas, in the case of a retroflexed fricative, sibilant, or affricate, such a release of the tip of the tongue is irrelevant as far as the production of the sound is concerned. Hence, the tongue could remain retroflexed even after the completion of a fricative, and could thus affect a following consonant. Since the tongue has to be necessarily released from its retroflexed position at the termination of a stop, flap, nasal or lateral, its retroflexion cannot affect a following consonant, except when the latter forms part of the release itself. However, since the curling of the tongue could occur prior to the production of these sounds, and is not part of their production itself, such sounds could have an anticipatory effect on any of the preceding sounds.

The retroflexing property of a non-retroflexed apical tap or trill could also be explained in a similar way through an examination of the articulatory movements involved. For producing a non-retroflexed tap, the tip of the tongue evidently starts from a non-retroflexed position. Hence, the question of anticipatory retroflexion does not arise in this case. However, the tapping could involve the movement of the tip from a non-retroflexed position to a retroflexed position. In fact the articulation of an apical tap in KANNADA (DRAVIDIAN) does involve such a movement. For example, in the articulation of a word like brahma the tip of the tongue curls in immediately after the production of r (the "curling in" forming the release of the tap) and remains so until the end of the word itself. Thus the retroflexed flap and the apical tap form two opposing articulation, the former with the tip flapping out from a retroflexed position, and the latter with the tip tapping in from a non-retroflexed position. This, we believe, could be the basis of their opposing effect on the neighboring sounds found in most of the languages examined by us: non-retroflexed tap induces retroflexion on the following sounds, and retroflexed flap on the preceding sounds.

3.2.4. a following back vowel. It has been pointed out above that the retroflexed consonants have the property of neutralizing the front-back distinction occurring in the preceding vowels, mainly by centralizing a preceding front vowel (3.2.2.(4)). It could now be seen from the following examples, that a corresponding correlation exists between the non-retroflexed -- retroflexed distinction in consonants on the one hand, and the front-back distinction in the following vowels on the other. The consonants involved are mainly affricates, fricatives, and liquids. The change in this case affects the preceding consonants, whereas in the former case it affected the preceding vowels.

(1) The absence of retroflexion before front vowels has been noted in the following cases:

a. In ACOMA of New Mexico (KERES family) retroflexed consonants (ç̣, ć̣, s̱̣, ṣ́, ẕ̣) do not not occur before front vowels (Miller, 1965).

b. In CARIB (Guiana) the reverse flap ɾ̣ is an alveolar tap before i and e (and also after i) (Grimes, 1972).

c. Retroflex ç̣ of CAVINENA (TAKANAN) corresponds to alveolar sibilant in CHAMA before front vowels (Key, 1968).

d. In MARINAHUA and CHACOBO (PANOAN), s̱̣ does not occur before i or ĩ; in SHIPIBO-CONIBO it does not occur before i (or ĩ) in the same morpheme (Shell, 1965).

e. In LISU (SINO-TIBETAN), a retroflexed continuent occurs in inherited items, except before i (Burling, 1967).

f. In SINDHI (INDO-ARYAN), retroflexed stops are post-alveolar syllable-initially before a high front vowel (Bordie, 1958).

g. In BELANGAO (Philippines) r is a non-retroflexed lateral while occurring contiguously to a front vowel (Shetler, 1966).

h. MAYAN *c̆ and *s̆ changed to ç̣ and s̱̣ respectively in common MAMEAN, except before i (Kaufman, 1969).

(2) On the other hand, the following instances indicate the occurrence of retroflexion before back vowels:

a. In ACOMA (New Mexico), the palatal affricates and sibilants are slightly retroflexed before ə and u (Miller, 1965).

b. In MAZATEC (POPOTECAN) s̆ has a retroflexed allophone before back vowels (Gudschinsky, 1959).

c. PROTO-MAZATECAN *č became ç̌ in the San Miguel SOYALTEPEC dialect before back vowels when occurring in cluster with *h, but not after *n (Gudschinsky, 1959).

d. In MOLINOS MIXTEC š and ž are retroflexed before a, o, u, but not before front vowels (Hunter and Pike, 1969).

e. UTO-AZTECAN *c has become s̱ before back vowels but s before front vowels in PAPAGO (Voegelin, Voegelin and Hale, 1962).

f. In the AKUKU AKUMAZI dialect of IKA (Nigeria) r is a retroflexed flap before back vowels, and an alveolar flap before non-back vowels (Williamson, 1968).

g. In GARHWALI (INDO-ARYAN) s is retroflexed before (or after) back vowels (Chandrasekhar, 1970).

h. BANTU *lî has changed to l̩i and dialiectally to d̩i in VENDA. This close î in its turn, however, is considered to have originated from an earlier *ui (Meinhof, 1932) and is hence a supporting instance.

i. The PROTO-ATHAPASKAN *k̂^{w} (labialized front velar) series is said to have changed into a series with strong retroflexion or retroflex affrication in a number of ALASKAN languages (Kraus, 1964).

(3) In the following two instances (and also in (1.b) above), a front vowel appears to affect the retroflexion of a following consonant:

a. In WALMATJARI (AUSTRALIAN) the contrast between ṭ, ṇ, ḷ and t, n, l is neutralized after i (Hudson and Richards, 1969).

b. In MANTJILTJARA (AUSTRALIAN), retroflexion is very weak after i, i: medially (Marsh, 1969).

(4) In the following three instances (and also in (2.g) above), a back vowel appears to induce retroflexion on a following consonant:

a. In WERI (New Guinea) l is a retroflexed lateral after back vowels (Boxwell, 1966).

b. In TELEFOL (New Guinea) l tends to be retroflexed in word-final position after a (Healey, 1964).

c. In BRETON (CELTIC), l after u and o and nn after o are reported to be retroflexed (Jackson, 1967).

There are two possible exceptions to the above generalization. Firstly, the change of s to ṣ in SANSKRIT is reconstructed to have taken place before high vowels (both front and back). Secondly, the reconstructed *c of PROTO-POPOLOCAN has become ç in POPOLOC before i and u in non-initial syllables, and the reconstructed s to ṣ in CHOCHO before e, before back vowels in stressed syllabes and in medial syllables, and before i in stressed syllables (Gudschinsky, 1959). These need further examination.

3.2.5. Implosion. Another interesting environment that induces retroflexion in a dental voiced stop is its implosion. According to Greenberg (1970), the retraction to the alveolar or alveopalatal position of an implosive corresponding to a non-implosive dental could be considered as a normal articulatory feature. An "extension" of this retraction is seen in its retroflexion found in a number of AFRICAN languages belonging to the retroflexion area described above. Thus, Tucker and Bryan (1966) report the occurrence of retroflexion in the apical implosives of MORU-MANGBETU languages (slight), BONGO-BAGIRMI languages (slight in BAGIRMI, but according to Santandrea (1963) strong in BONGO), BERTA, BEDAUYE, SIDAMO and SOMALI (slight). They are also said to occur in most of the eastern SUDANIC languages (Tucker, 1940), and in the CUSHITIC and OMOTIC languages of Ethiopia (Bender et al.). In SINDHI (INDO-ARYAN), initial d and medial -dd- and -ḍḍ- (of PRAKRIT) have changed into retroflexed implosives (Turner, 1924); that is, the dental and retroflexed voiced stops have merged together as retroflexed post-alveolar rather than non-retroflexed dental, because of the accompanying implosion. Thus, the articulatory effect of implosion on apical stops appears to be similar to that of a following vowel.

3.2.6. Other environments. In addition to the environments discussed above, there are also a few others that appear to induce retroflexion in the neighbouring sounds; however, their occurrence is comparatively less frequent, and in some cases they show even contradictory values. Hence, additional data is necessary before one could specify the exact nature of their influence in retroflexing the neighboring sounds.

(1) Word-initial position appears to cause retroflexion in the following cases:

a. In LUSENO, UTO-AZTECAN *s became ṣ initially (Bright and Hill, 1967).

b. In TARASCAN (Mexico), s is retroflexed word-initially (Foster, 1969)

c. In SA'BAN (Borneo) r is a retroflexed fricative initially, and alveolar elsewhere (Clyre, 1973).

d. In WESTERN ZOQUE and in MIXE, PROTO-ZOQUE *s became s̱ initially (Wonderly, 1949). (This study, however, does not specify the realizations of this proto-phoneme in other environments.)

e. In BURERA (Australia), the alveolar consonants t, n, r and l have retroflexed variants initially (Glasgow, 1967).

f. In ANYULA (Australia), r has a free variant r̤ initially (Kirton, 1967).

The initial position, however, has other effects on the sounds occurring in it:

g. In the SA'BAN instance quoted above (c.), the initial retroflexed fricative has an onset of voicelessness.

h. In KUNIMAIPA (New Guinea), the retroflexed r is occasionally represented by the allophone [t̤r] initially (Pence, 1966).

i. Throughout KEWA, r is [t̤r] initially (Franklin, 1968).

j. In CAMSA (Columbia), r is a retroflexed fricative initially, and a flap elsewhere (Howard, 1967).

Contrary to the retroflexing effect of the word-initial position pointed out above, the following instances indicate the deretroflexing effect of the initial position:

k. In TELUGU (DRAVIDIAN), an initial d̤ (brought to that position through metathesis) has changed to d (Krishnamurti, 1960).

l. In TULU (DRAVIDIAN), an initial d̤ (brought to that position through the elision of the first vowel in words of VCVCCV type) has changed to d (Bhat, 1965).

m. In ANYULA, d̤ is [d] word-initially (Kirton, 1967).

(2) Velar or palatal. Another interesting environment in which retroflexion appears to occur is a preceding or a following velar consonant or a palatal sibilant. The following instances have been noted:

a. In SANGLECHI *ks has changed to ɭ (and somes to l) (Morgenstierne, 1938).

b. In SANSKRIT, INDO-EUROPEAN *s to ṣ after k (Katre,1942).

c. In TARASCAN (Mexico), š is slightly retroflexed before k (also before p) (Foster, 1969).

d. In SERRANO (California), UTO-AZTECAN *i and *u became ɨ and *a became ạ (retroflexed vowels) in combination with the geminating transition (which could be reconstructed as an uvular consonant) after non-labialized consonants except ṣ (Hill, 1969).

e. In YUMA (California, r has a retroflex pronunciation when preceded by š and an unaccented short vowel (Halpern, 1946).

f. In PRAKRIT, dentals change to retroflexed consonants under the influence of a sibilant (Mehendale, 1948).

A counter example is Trondheim NORWEGIAN, where ṭ, ḍ, ṇ, ɭ are post-alveolar before š (Vanvik, 1966).

A velar itself changes to a retroflexed apical before a dental stop in the following cases:

g. In SANSKRIT *kt to ṣṭ (Burrow, 1955).

h. In KOTA (DRAVIDIAN) stem-final g is replaced by ṛ before t (Emeneau, 1944).

i. KHYANG k corresponds to LUSHAI retroflex stop or affricate (Bright, 1960).

(3) Other environments noted are the following:

a. In SIONA (TUCANOAN) the glottalized counterpart of the alveolar stop is usually retroflexed (Wheeler, 1962).

b. PROTO-DRAVIDIAN *r̄ (alveolar stop or tap) is ṭ after a nasal in Ceylon TAMIL (Pillai, 1962).

c. In KOTA (DRAVIDIAN) n changes to ṇ before y (Emeneau, 1944).

d. PIRO (ARAWAKAN) r is a retroflexed sibilant after n, especially when preceding o (Matteson, 1965).

3.3. The onset and spread of retroflexion in a given language or language group appears to follow a definite direction. It affects the fricatives, trills, and laterals to begin with, and then spreads on to stops and affricates. Thus, in languages in which retroflexion is only a marginal feature (and is also probably a recently acquired feature), the sounds affected by it are most commonly the fricatives, flaps, trills and continuents. Whereas in languages in which it has a more prominent status, and has probably a longer developmental history, it occurs with stops, affricates and nasals. Similarly, when in cases such as that of the implosives, the feature affects a stop in the initial stage itself, its presence appears to be rather unstable. In many such instances, the retroflexed stop has been reported to give place to ʔr or ʔḷ through further changes (Greenberg, 1970). The change of intervocal ḍ to ḷ in the earliest stage of SANSKRIT also supports this generalization regarding the development of retroflexion.

In the case of INDO-ARYAN, the spread of retroflexion from the fricatives to stops and nasals as the second stage of its development has coincided with the loss of that feature from fricatives, and later on from laterals and nasals also in some areas (Allen, 1954). Could we consider such a coincidence as part of the general tendency of its development? (see 2.1.6.) Further study is necessary to take any definite stand on this point.

3.4. Loss of retroflexion and other changes. The changes that affect the retroflex stops intervocally are markedly different from those that affect other intervocalic stops. Generally, stops tend to become spirentized and then get elided in the intervocalic position. However, as seen in MIDDLE INDO-ARYAN and certain MUNDA and DRAVIDIAN languages, the retroflex stops intervocally tend to become flaps, and change further to taps, trills or laterals. In certain AUSTRALIAN languages such as MANTJILTJARA and WALMATJARI and also in the MELANESIAN IAI the change of intervocalic retroflexed stop to flap or tap corresponds to the spirantization of non-retroflexed stops in that position. Similarly, in the PANJGUR dialect of BALUCHI intervocalic d becomes ð but ḍ becomes r.

The above tendency, however, does not appear to be a characteristic of the retroflexed stops as such. In a number of AFRICAN and AMERICAN INDIAN languages the alveolar stop has been reported to change into a trill or a lateral in a similar situation. Hence, it is probably their being apico-alveolar that gives this specific direction of change to these sounds.

Loss of retroflexion from laterals, nasals, fricatives and flaps could clearly take place unconditionally. A number of languages in India belonging to different language families have undergone such a change. However, the occurrence of retroflexion in stops (excepting the implosives) appears to be highly stable. As we have pointed out

above, it also probably represents an "advanced stage" in the development of retroflexion in a language or language group. The only clear instance of the unconditioned loss of retroflexion from stops is that of ASSAMESE (INDO-ARYAN) which, however, may have a different explanation such as the presence of a substratum. If the reconstruction of retroflexion in some of the proto-languages of AMERICAN INDIAN languages such as the MAYAN or the TAKANAN is correct, its unconditional loss could be seen occurring in affricates as well.

However, such reconstructions of retroflexion are becoming increasingly suspicious. The tendency, a few decades back, was to reconstruct a full series of retroflexed consonants even when it is found only marginally in the daughter languages. Such a tendency could be seen in the reconstructions of COMMON INDONESIAN (Dempwolff), URAL-ALTAIC (Collinder), BANTU (Meinhof), and others. The recent tendency, however, is to suspect such reconstructions (see Stampe, 1966 for MUNDA; Oates, 1967 for AUSTRALIAN; Handricourt, 1965 for AUSTRONESIAN; Raun, 1971 for FINNO-UGRIC; Kaufman, 1969 for MAYAN; and 2.2.5. above for CHINESE). The geographical contiguity of languages with retroflexed sounds appears to indicate that this recent trend in reconstruction is moving in the right direction: languages rarely lose retroflexion once they acquire it, and hence it is easier to postulate its introduction into a language rather than its loss from a daughter language.

3.5. Registral and social functions. In ARMENIAN (Allen, 1950) and in PITTA PITTA (Blake and Breen, 1971) loss of retroflexion is said to occur in rapid speech. In CHAM (Vietnam) retroflexion is confined to men's speech only: ṭ of men's speech corresponds to ty of women's speech (Blood, 1967). In the COMACHUEN dialect of TARASCAN ṛ becoming l is a regular change for women and children (Friedrich, 1971). In San Felipe dialect of OTOMI a dimunitive style of speech exists (used when talking to a small child) in which all sounds in a word are retroflexed (Bartholomew, 1960).

3.6. Retroflexion in borrowed and native items. It appears possible to make a distinction between changes that affect retroflex sounds in borrowed items and those that affect them in native items. In MALAYALAM (DRAVIDIAN), for example, the retroflexed sibilant ṣ of SANSKRIT is reported to occur as ṭ in borrowed items (Chandrasekhar, 1953). In HINDI (INDO-ARYAN), SANSKRIT ṣ in borrowings becomes kh, but s in native items (Allen, 1953). In YIDGHA (IRANIAN) borrowings from KHOW show a replacement of ṭ by ky

(Morgenstierne, 1938). As has been pointed out above, the unconditioned change of retroflexed stops into non-retroflexed stops is rather rare as a regular historical process, but in borrowings (as seen in THAI, for example), such a change appears to be quite common. Similarly, the unconditioned replacement of non-retroflexed stops by their retroflexed counterparts is common as in Indian ENGLISH, but such a change does not appear to function as a regular historical process in native items.

The separation of lexical items into inherited and borrowed sets is an exceedingly tedious job in diachronic linguistics. Hence, a distinction of the above nature between changes occurring in inherited items on the one hand and those occurring in borrowings on the other could be quite helpful.

4. Certain synchronic aspects.

4.1. Most common retroflexed sounds. The most commonly occurring retroflexed sounds (from the point of view of languages) are the flap, voiced and voiceless stop, fricative or sibilant (mainly voiceless), nasal, lateral and affricate. Of these the flap and the fricative are more or less uniformly distributed, occurring in all the areas studied, even though the flap is rather rare in the AMERICAN INDIAN languages, and the fricative is correspondingly rare in the INDIAN languages. Affricate is almost exclusive to the American area (AFRICAN affricates are generally reported to be trilled), and the stops, nasal, and the plain (not flapped) lateral are predominently seen in Australia proper and in India. Languages having a retroflexed nasal generally have a retroflexed stop (or affricate) as well. Exceptions to this are 1) BRETON with a retroflexed lateral and nasal, whose occurrence, however, is doubted by Jackson (1967), and probably 2) SINESIP of Central New Hebrides (Voegelin et al., 1965).

4.2. Markedness of retroflexion. Retroflexion is evidently a marked feature (Greenberg, 1966), both in consonants as well as in vowels. It is introduced into a language mainly through the assimilatory influences of neighboring sounds such as back vowels, velar consonants, r, or at a later stage by other retroflexed consonants. Hence, its occurrence in most of the languages is restricted to one or more of these limited environments. Even in languages where there are no such specifiable environments that limit its occurrence, the retroflexed consonant is comparatively more restricted than the corresponding non-retroflexed consonant.

Secondly, the text frequency of retroflexed sounds in the following five languages examined is considerably lower than that of the corresponding non-retroflexed consonants: BENGALI (Ferguson, 1960), OSTYAK (Gulya, 1966), MARATHI (Bhagawat, 1961), TULU (Bhat, 1967), HINDI (Ghatage, 1964). The only exception was ḷ in TULU which has a higher text frequency as compared to l. The diachronic explanation to this is the fact that ḷ of this particular dialect of TULU comes from the merger of two different PROTO-DRAVIDIAN retroflexed consonants: a lateral and a continuant. We believe that the text frequencies of retroflexed and non-retroflexed consonants generally show similar ratios in other languages as well.

Thirdly, the total number of retroflexed consonants is never greater than that of the non-retroflexed apical consonants in any of the languages examined by us. It is possible to make a stronger claim that generally (though not universally) every retroflexed consonant in a given language would have a corresponding non-retroflexed apical consonant. Exceptions to such a claim are the occurrences of retroflexed flaps and laterals with no corresponding non-retroflexed apical sounds in some languages.

Another criterion postulated by Hockett (1955) for distinguishing marked from unmarked features is the occurrence of a wider range of non-distinctive variation in the unmarked set of segments. Retroflexion appears to contradict this postulation. In the languages examined by us, the range of allophonic variation (as noted by the grammarians) generally appears to be greater for retroflexed consonants than for the corresponding non-retroflexed ones.

4.3. The place of retroflexion in phonetics. There is some controversy regarding the place of retroflexion in a system of phonetics. In the feature system of Jakobson, Fant, and Halle (1963), it has been taken care of, along with lip-rounding and pharyngealization by the opposition flat vs. plain. As pointed out above (1.3.) the former (flatness) is manifested by a downward shift of a set of formants or even of all the formants in the structure. Another suggestion (see Raun, 1971) was to set up a "secondary" feature, representing the "retraction from the primary position" as from bilabial to labiodental, dental to alveolar, and non-retroflexed to retroflexed. According to Chomsky and Halle (1968), the distinction between retroflexed and non-retroflexed (alveolar) obstruents could be correlated with a distinction in the articulators used: tongue-tip (-distributed) for the former and blade (+distributed) for the latter. Such a correlation, however, as pointed out by Ladefoged (1970), is controverted by

the occurrence of non-retroflexed tip alveolar stop contrasting with dental as well as retroflexed apical stops in languages like MALAYALAM (DRAVIDIAN).

Others, like Ladefoged (1970), suggest that the above distinction could be correlated with a distinction in the place of articulation. That is, retroflexed consonants could be considered as post-alveolar consonants. Such a solution is preferable to those given earlier, because, it could take care of some of the characteristics of the environments that induce retroflexion in a neighboring sound (back vowels, velar consonants, implosion). It could also explain the retracting effect of retroflexed consonants on the vowels occurring before them, and also the distinct direction generally shown by the diachronic changes that affect intervocalic apico-alveolar stops (3.4.). However, it would fail to take care of the following points which we believe, are of crucial importance for an understanding of retroflexion: 1) the complimentariness between r and retroflexed consonants in inducing retroflexion on neighboring sounds (3.2.2.); 2) the prosodic nature of retroflexion as seen in SANSKRIT (Allen, 1954) and OTOMI (3.5. above); 3) the geographical clustering of languages having retroflexion as an articulatory feature; and 4) the contrast between normal, retracted and retroflexed vowels occurring in BADAGA (1.2.). It is hence necessary, we believe, to postulate retroflexion or the curling of the tip of the tongue as a distinct articulary feature.

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Abbreviations:

AL	Anthropological Linguistics
BSOAS	Bulletin of the School of Oriental and African Studies
IJAL	International Journal of American Linguistics
IL	Indian Linguistics
UCPL	University of California Publication in Linguistics

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